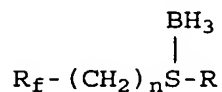


WHAT IS CLAIMED IS:

1. A fluorous borane-sulfide having a structure



wherein  $\text{R}_f$  is a fluorinated hydrocarbon chain containing one to twelve carbon atoms; R is  $\text{C}_{1-4}$ alkyl or  $(\text{CH}_2)_n - \text{R}_f$ ; and n is 1 to 3.

2. The borane-sulfide of claim 1 wherein  $\text{R}_f$  contains four to ten carbon atoms.

3. The borane-sulfide of claim 1 wherein  $\text{R}_f$  contains six to eight carbon atoms.

4. The borane-sulfide of claim 1 wherein  $\text{R}_f$  is perfluorinated.

5. The borane-sulfide of claim 1 containing at least 35%, by weight of fluorous sulfide, fluorine.

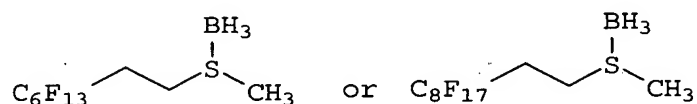
6. The borane-sulfide of claim 1 containing at least 35% to about 70%, by weight of fluorous sulfide, fluorine.

7. The borane-sulfide of claim 1 wherein R is methyl or ethyl.

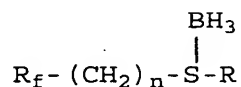
8. The borane-sulfide of claim 1 wherein n is 2.

9. The borane-sulfide of claim 1 wherein  $R_f$  is  $C_6F_{13}$  or  $C_8F_{17}$ .

10. The borane-sulfide of claim 1 having a structure

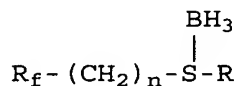


11. A composition comprising a fluororous borane-sulfide having a structure



and a fluororous sulfide having a structure  $R_f-(CH_2)_n-S-R$ , wherein  $R_f$  is a fluorinated hydrocarbon chain containing one to twelve carbon atoms; R is  $C_{1-4}$ alkyl or  $(CH_2)_n-R_f$ ; and n is 1 to 3.

12. A method of hydroborating an alkene or an alkyne comprising reacting the alkene or alkyne with a fluororous borane-sulfide having a structure



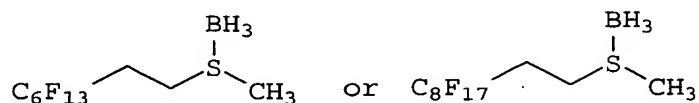
wherein  $\text{R}_f$  is a fluorinated hydrocarbon chain containing one to twelve carbon atoms;  $\text{R}$  is  $\text{C}_{1-4}$ alkyl or  $(\text{CH}_2)_n\text{-R}_f$ ; and  $n$  is 1 to 3.

13. The method of claim 12 wherein the hydroboration is performed in the presence of a fluororous sulfide having a structure  $\text{R}_f - (\text{CH}_2)_n - \text{S} - \text{R}$ , wherein  $\text{R}_f$  is a fluorinated hydrocarbon chain containing one to twelve carbon atoms;  $\text{R}$  is  $\text{C}_{1-4}$ alkyl or  $(\text{CH}_2)_n\text{-R}_f$ ; and  $n$  is 1 to 3.

14. The method of claim 12 wherein  $\text{R}_f$  is perfluorinated.

15. The method of claim 12 wherein  $\text{R}_f$  is  $\text{C}_6\text{F}_{13}$  or  $\text{C}_8\text{F}_{17}$ .

16. The method of claim 12 wherein the fluororous borane-sulfide is

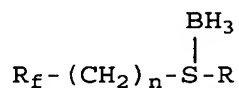


17. The method of claim 12 wherein the hydroboration is performed in a solvent comprising a fluorinated hydrocarbon.

18. The method of claim 17 wherein the solvent further comprises a second solvent that is immiscible with the fluorinated hydrocarbon.

19. The method of claim 17 wherein the fluorinated hydrocarbon is selected from the group consisting of perfluorohexane, perfluoroheptane, perfluorooctane, perfluorononane, perfluorocyclohexane, perfluoromethylcyclohexane, perfluoro-1,2-dimethylcyclohexane, perfluoro-1,3-dimethylcyclohexane, cis-perfluorodecalin, trans-perfluorodecalin, perfluorokerosene, perfluoromethyldecalin, and mixtures thereof.

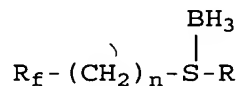
20. The method of claim 12 comprising further steps wherein a sulfide by-product of the hydroboration reaction having a formula  $R_f(CH_2)_n-S-R$  is separated from the reaction mixture, then reacted with  $BH_3$  to regenerate



21. The method of claim 12 comprising further steps wherein a product of the hydroboration reaction is treated with a base and an oxidizing agent to provide an alcohol.

22. The method of claim 18 wherein the oxidizing agent is hydrogen peroxide.

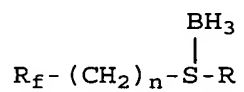
23. A method of reducing an organic functionality of a compound comprising reacting the functionality with a fluoroborane-sulfide having a structure



wherein  $R_f$  is a fluorinated hydrocarbon chain containing one to twelve carbon atoms;  $R$  is  $C_{1-4}$ alkyl or  $(CH_2)_n-R_f$ ; and  $n$  is 1 to 3.

24. The method of claim 23 wherein the organic functionality is selected from the group consisting of cyano, amido, acyloxy, and keto.

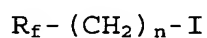
25. The method of claim 23 comprising further steps wherein a fluorous sulfide by-product of the reduction having a formula  $R_f-(CH_2)_n-S-R$  is separated from the reaction mixture, then reacted with  $BH_3$  to regenerate



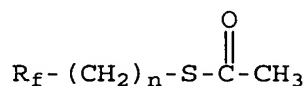
26. A method of manufacturing a fluorous sulfide having a structure  $R_f-(CH_2)_n-S-R$ ,

wherein  $R_f$  is a fluorinated hydrocarbon chain containing one to twelve carbon atoms;  $R$  is  $C_{1-4}$ alkyl or  $(CH_2)_n-R_f$ ; and  $n$  is 1 to 3,

comprising the steps of (a) reacting a compound having a formula



with potassium thioacetate to provide a compound having a structure



(b) then reacting the product of step (a) with sodium methoxide and a compound having a structure  $R-I$  to provide the fluorous sulfide.